Nuclear applications

Nuclear applications in medicine

Introduction

The beneficial contribution of nuclear technology to the production of electricity via commercial nuclear power plants is well-known worldwide. But most are unaware that the impact of nuclear technology is even greater for non-energy applications, such as applications in medicine, agriculture and industry. Medical uses of nuclear technology are perhaps the most widely known, ranging from diagnostic to therapeutic applications, and sterilization of equipment.

134 out of 195 countries operate nuclear medical facilities. Nuclear medicine is applied to various departments of medicine: oncology, cardiology, neurology, pneumology or even paediatrics. It helps to diagnose and treat complex diseases, such as cancer. Without a doubt, innovation in research and development is a driving force in nuclear medicine. New devices, radiopharmaceuticals, clinical applications, and evidence-based medicine are produced at a fast pace. Nowadays, theranostics being one of the main development domains with significant questions to specific radioisotopes to be provided.

Overall, nuclear medicine is growing, on average, by some 10% yearly from today's market value of around 6.5 B$.

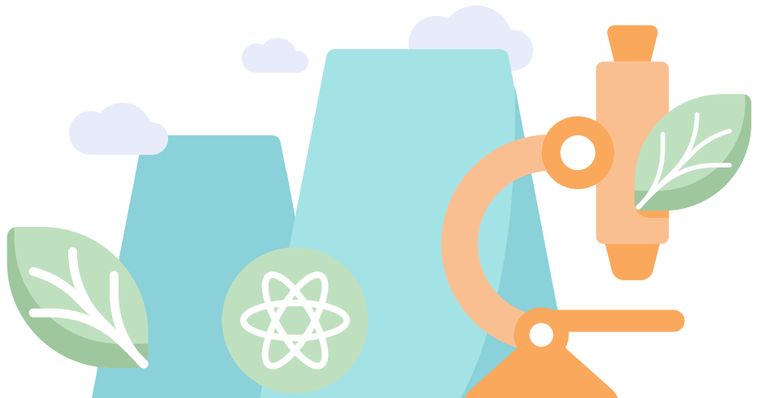
The development of nuclear medicine has been very successful since its beginning. Reaching far beyond electricity generation, the field of nuclear medicine has been innovative and able to quickly adapt to new scientific developments and clinical needs for the past couple of decades and there is no question that the future of this field is bright.

Some nuclear vendors expand their expertise to the medicine sector, defining a new era in current and future diagnostic and therapeutic procedures. For instance, this year Framatome established Framatome Healthcare to unite under the new brand all medicine-related activities. And Rusatom Healthcare which is a Rosatom's subsidiary develops its competencies in nuclear medicine by taking part in the construction of hospitals, building sterilization centres, fabricating isotopes and manufacturing of medical equipment.

Diagnostic techniques

For many years, people have had the perception that radioactive materials can be harmful to the body and, when uncontrolled, this can often be the case. However, advances in nuclear medicine have brought great benefits. Diagnostic techniques in nuclear medicine use radiopharmaceuticals (or radiotracers) which emit gamma rays from within the body. These procedures use small amounts of radioactive material for scans and diagnostic techniques. This treatment helps to trace diseases and abnormalities in the human body at the earliest stage. The function and activity of organs can be imaged by registering the gamma rays as they are emitted from the body, as both soft tissue and bone can be examined. The tracers used are generally short-lived isotopes, and can be administered orally, by injection, or by inhalation, depending on which is most appropriate for the procedure being conducted.

The benefits of these procedures far outweigh any risks that are present due to the exposure to radiation, and nuclear medicine is now widely accepted as a vital part of health care. Nuclear medicine continues to be developed and the latest imaging technology, known as Positron Emission Tomography (PET) can be used in effective, and non-evasive, cancer diagnosis.



Therapy techniques

The history of nuclear medicine begins with Henry Bequerel's discovery of radioactivity in 1898. A few years later in 1903, Alexander Bell suggested placing radioactive sources near tumours to treat them. Turns out, Bell was onto something. Since then, the field of nuclear medicine has advanced significantly and nuclear techniques are now commonly used to treat cancer patients and others with medical conditions.

One of the most famous isotopes in nuclear medicine is Iodine-131. Iodine-131 was first discovered in 1938 at the University of California, Berkeley by Glenn Seaborg, a nuclear chemist and a pioneer of nuclear medicine. It is most famous for its use to treat cancers of the thyroid gland using beta radiation, but has also been used in other applications like diagnosing abnormal liver function, renal (kidney) blood flow, and urinary tract obstruction because it is also a weak gamma emitter. I-131 is extremely convenient because it combines easily with other elements, like sodium, for easy ingestion as either a pill or liquid, and has an 8-day half life, meaning that it flushes out of the body quickly. Studies of the efficacy of I-131 treatment have shown long-term cure of thyroid cancer approaching 80% and today, thyroid cancer is one of the most curable cancers with an over 90% survival rate, due in part to advances in nuclear science.

FORATOM and Nuclear Medicine Europe Position Paper

Lifesaving nuclear medicine applications deserve better recognition and support at EU level

The position paper titled 'Medical Uses of Nuclear Technology: Role, Challenges & Perspectives", jointly published by the FORATOM and Nuclear Medicine Europe in June 2021, explains the technicalities of nuclear medicine, presents the scope of the current nuclear medicine sector in the European Union as well as highlights the challenges that have to be overcome both at regulatory and supply chain levels.

"Nuclear technology offers many different important applications apart from providing low-carbon electricity at an affordable cost. Nuclear medicine is one of them as it enables access to diagnostic and lifesaving treatments technologies. Although the EU is involved in the nuclear medicine sector and its developments, more has to be done to address the current challenges in order to maintain the edge that the EU enjoys today in this field globally".

Yves Desbazeille, FORATOM Director General

"The European nuclear medicine sector – like the wider nuclear industry – faces several challenges, from negative attitudes towards nuclear energy/radiation, uncertainty over funding in new nuclear energy capacity and management of nuclear waste. It has, however, also its own challenges, such as a regulatory system that needs improvement, sustainable reimbursement models and equal access to modern equipment and applications across all member states. We recommend that nuclear technology and its non-power applications should be better recognised and supported at EU level. We also call for an EU roadmap dedicated to nuclear medicine research and development".

Antonis Kalemis, President of Nuclear Medicine Europe

Source

www.foratom.org/press-release/lifesaving-nuclear-medicine-applications-deserve-better-recognition-and-support-at-eu-level/

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